

# Variable Speed Drive Applications in the High-power Industrial Market

## Application Note 1253

### High-power Industrial Market

The high power electric drive and motor market (power ratings of 75 kW or higher) is poised to see a continued period of strong growth. High power rated electric drives worldwide have a significant share in the total drive market of up to 30%. The dynamic of this market separates it from low power rated drives sectors, mainly due to the higher specialization and unit cost of these drives. The industrial HVAC subsegment is expected to have a CAGR of 49.4% while the material handling market segment will show a CAGR of 16.3% from 1998 to 2003.

### Typical Applications

High-power variable speed industrial drives are common in the HVAC market segment with end applications such as air handling units, refrigeration units, and cooling towers. AC drives have been used on pumping applications for nearly 30 years. The trend for high power drives is toward drives that can immediately be integrated into existing communication networks.

### Gate Drive Optocouplers

Agilent Technologies offers a broad range of gate drive optocouplers which provide uncompromising performance, a wide range of features, low cost, and high reliability solutions for motor drive applications. All of Agilent's gate drive optocouplers meet stringent motor drive requirements with high performance.

### Current Sensing Optoisolators

Variable speed drives in the high power industrial market require current sensing for the purposes of short circuit detection, torque control or motor overload measurements. Agilent's current sensing optoisolators have very high common-mode-transient-rejection capability (CMR), which is often necessary in modern, fast switching, motor control electronics. In addition, Agilent current sensing optoisolators offer a digital output for direct connection to microcontrollers / DSPs. They have excellent gain and offset characteristics, especially very low offset drift over a wide temperature range.



### Main Components of a Variable Speed Drive

A typical driver and power control system of variable speed motors comprises three main elements:

- (1) microcontroller/DSP
- (2) gate driver optoisolator and
- (3) insulated gate bipolar transistor (IGBT).

#### 1. Microcontroller / DSP

High performance motor drives require precision timing for turning on and off the power devices on the drives. The DSP processing of speed advantage compared to microcontrollers allows multiple peripheral component inputs to be processed simultaneously. The high degree of integration and low pin counts of DSP devices over microcontrollers saves overall system development costs, maintains ease-of-use, and ensures the reliability of end applications. With each generation of DSP more and more useful peripherals are increasing functionality and reducing the overall system cost.

#### 2. Gate Drive Optocouplers

Optocouplers have been extensively used to isolate delicate, low-power and expensive electronic components from high-power circuits. In addition, optocouplers provide an excellent means of interfacing circuits with high voltage potential difference while reducing noise and interference. Specifically, optocouplers are optimized to provide high-output sourcing and sinking capabilities to drive inverters.

#### 3. IGBTs

The most recent advances in drive technology have gone hand in hand with improvement in both size and performance of power switching devices known as insulated gate bipolar transistors. Ideal for low level signal to power control, motor drives use IGBTs to provide fast, accurate operation, electronic signals to the motor, and quiet operation.

#### For Further Details:

More specific information is available on the Agilent Optocoupler web site:

[www.agilent.com/view/optocouplers](http://www.agilent.com/view/optocouplers)

#### Related Information on Agilent Variable Speed Drive Components:

- *“Optocouplers for Variable Speed Motor Control Electronics in Consumer Applications”*
- AN1254, *“Variable Speed Drives in Low Power Industrial Applications”*
- AN1252, *“Variable Speed Drives in the Consumer Market”*
- Product selection guide for Gate Drive and Current Sense Couplers including IGBTs for variable Speed Drives

## Recommended Products

Agilent Gate Drive Optocoupler Device	HCPL-316J	HCPL-J312	HCNW-3120	HCPL-3120
Min. Peak Output Current	2 A	2 A	2 A	2 A
Min. CMR	15 kV / $\mu$ s	15 kV / $\mu$ s	15 kV / $\mu$ s	15 kV / $\mu$ s
Max. Propagation Delay	0.5 $\mu$ s	0.5 $\mu$ s	0.5 $\mu$ s	0.5 $\mu$ s
UVLO (*) / FAULT	Yes / Yes	Yes / No	Yes / No	Yes / No
Package Type	SO-16	DIP 8	8 Pin Widebody	DIP 8
VDE 0884 [ $V_{iorm}$ ] / UL [ $V_{iso}$ ]	891 $V_{peak}$ / 3750 $V_{rms}$	891 $V_{peak}$ / 3750 $V_{rms}$	1414 $V_{peak}$ / 5000 $V_{rms}$	630 $V_{peak}$ / 2500 $V_{rms}$ (**)

(\*) Under Voltage Lockout

(\*\*) Option 060 required

Recommended IGBT Devices	Recommended Supplier	$BV_{CES}$ (min.)	$I_C$ @ 100°C	Package	$T_J, T_{STG}$
IRG4PH40KD	International Rectifier	1200 V	15 A	TO-247AC	-55 to +150°C
SGL25N120RUF	Fairchild	1200 V	25 A	TO-264	-55 to +150°C
BUP313D	Infineon	1200 V	20 A (*)	TO-218AB	-55 to +150°C

(\*) Specified in the data sheet for  $T = 90^\circ\text{C}$

Note: Data subject to change

Agilent Current Sensing Device	Package Type	Gain Tolerance	Nonlinearity	VDE 0884 [ $V_{iorm}$ ] / UL [ $V_{iso}$ ]
HCPL-788J	SO-16	5%	0.4%	891 $V_{peak}$ / 3750 $V_{rms}$

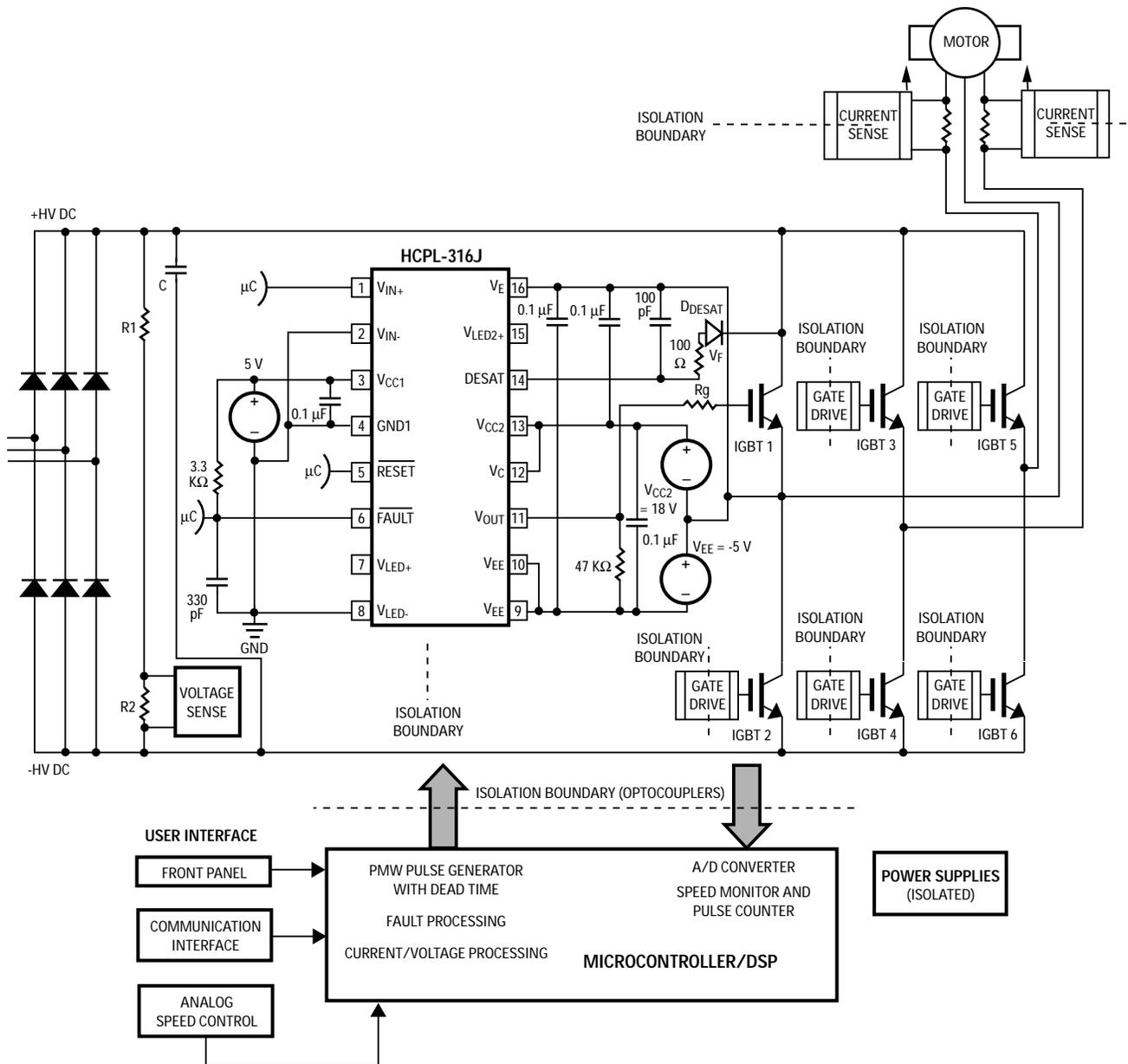


Figure 1. Reference Design HCPL-316J

[www.agilent.com/semiconductors](http://www.agilent.com/semiconductors)

For product information and a complete list of distributors, please go to our web site.

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Obsoletes 5988-3945EN

January 21, 2002

5988-5467EN

